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Butyrum Medicinalis :

A MONOGRAPH

1. INTRODUCTION

1.1 Purpose

This monograph is an attempt to codify a botanically derived fatty substance for the usage of the orthodox medical profession in particular, and then the generality of the healthcare industry.

1.2 Vernacular names

Nku-to (Twi, Ghana); Shea butter (English); Beurre de Karité (French).

1.3 Butyrum Medicinalis: Its meaning and rationalization

Butyrum Medicinalis is the Latinized version of the epithet “Medicinal Butter”, which name the author hereby confers on the subject of this monograph in pursuance of the motives discussed herein below. In order to facilitate prescription writing and dispensing the shorthand notation of “But. Med.” may be applied as such or fully capitalized. However, only the initial letters and both should be capitalized whenever the name “Butyrum Medicinalis” is written in full.

The reasoning that has guided the choice of name “Butyrum Medicinalis” is in threefold. Firstly, the propensity of the technical arts to employ technical vocabularies in preference to the vernacular. Almost every technical field of work has its unique set of specialized vocabulary, the medical profession none the less. From a psychosocial perspective, most especially in the countries where this product is naturally available, the author is opined that a consumer to whom is dispensed a medicament labelled “Butyrum Medicinalis” would exhibit behaviour of greater confidence toward it than when the label of “Shea butter” is attached to the same product. Secondly, Latin has been the source language for medical terminology. Indeed the practice of applying a Latinized nomenclature to the materia medica is still current, to which practice the author is seeking to conform. And thirdly, the fact that until now no fatty substance, natural or synthetic, is known in medical practice possessing of the full set of therapeutic effects that are discussed below when applied in the pure state without incorporation of another active compound. Medicated ointments and related preparations are categorically excluded from consideration by this criterion. On the contrary, the subject of this monograph is medicinally useful in the native state just as extracted according to the method discussed in a later section.

The aptitude of the code name “Butyrum Medicinalis” resides in the fact that the subject of this monograph is the first of its kind to be introduced to orthodox practice (precedence), in addition to its allusion to the medicinal utility of this substance at first glance.

2. SHEA: A SHORT ETYMOLOGICAL HISTORY

Historical records still extant attribute the Scottish explorer Mungo Park as the first person ever to mention the word “shea” in his writings. The following is an extract from the published version of Park’s diaries on his travel expeditions in west and central Africa during the late eighteenth (18th) century;

“... and being accompanied by the guide, I departed from the village on the morning of the 24th. About eight o’clock, we passed a large town called Kabba, situated in the midst of a beautiful and highly cultivated country; bearing a greater resemblance to the centre of England, than to what I should have supposed had been the middle of Africa. The people were everywhere employed in collecting the fruit of the Shea trees, from which they prepare the vegetable butter, mentioned in former parts of this work. These trees grow in great abundance all over this part of Bambarra. They are not planted by the natives, but are found growing naturally in the woods; and in clearing wood land for cultivation, every tree is cut down but the Shea. The tree itself very much resembles the American oak; and the fruit, from the kernel of which, being first dried in the sun, the butter is prepared by boiling the kernel in water, has somewhat the appearance of a Spanish olive. The kernel is enveloped in a sweet pulp under a thin green rind; and the butter produced from it, besides the advantage of its keeping the whole year without salt, is whiter, firmer, and, to my palate, of a richer flavour than the best butter I ever tasted made from cow’s milk. The growth and preparation of this commodity seem to be among the first objects of African industry in this and the neighbouring states; and it constitutes a main article of their inland commerce.

...”

— Mungo Park, 24th July 1796.

Travels in Africa, pp. 143—144.

The precise history of when and how mankind discovered the shea tree and began to use its products is now lost to us. However, it is very reasonable to believe that natives have known and consumed the products of the shea tree since early antiquity in the African countries (see below) where the tree naturally occurs. Indeed, natives have known and used the subject of this monograph for food, cosmetic and medicinal purposes for thousands of years. Nonetheless, Mungo Park is commonly credited as the first person to introduce the shea tree to the European continent. He is reported to have carried with him to Europe botanical drawings and specimens, and that he even attempted to classify the tree.

Park had encountered the shea tree and products derived from it during his journeys in present-day Senegal and Mali. The great importance that the natives accorded to the fatty substance prepared from the fruits of this tree both in commerce and daily usages was striking to him. In the then native Bambarra language of Mali the tree or the said product obtained from it was called “*shi*”, pronounced /ʃi:/, and rhyming with “tea”. In accordance with his Scottish accent Park constructed that word as “*Shea*” in his writings, imparting an ending “-a” which was not to be pronounced. This was the origin of the word “shea”, which

has undergone a remarkable transformation in the course of time. Currently in most English-speaking countries not only has the word “shea” endured usage but, especially in the African countries where the tree is indigenous, the ending “-a” is also pronounced, as in “yeah”.

3. THERAPEUTIC EFFECTS AUTHOR—ATTESTED

Butyrum Medicinalis exhibits a threefold medicinal effect when applied as a thick smear to the skin; antiinflammatory, local anaesthetic, and curative. The classical manifestations of inflammation have been four (4) and are namely reddening (Latin *rubor*), pain (*dolor*), swelling (*tumor*), and warmth (*calor*) of the affected body tissues. Anaesthesia in the concept here means the loss of sensation of pain; and to be curative is to possess the intrinsic ability to cause total healing or to restore a diseased or injured tissue to normal state.

The author has personally observed the following medicinal effects of Butyrum Medicinalis in the course of time, some of them serendipitously, and hereby recommends to the medical community to further test and practicalize these individually in orthodox practice. Generally, this product has been applied as a thick smear directly to the affected skin with a finger in a gentle rubbing motion.

3.1 Burns; Scalds

Momentary contact of the skin with fire or with a very hot solid or liquid will usually progress to blisters at the affected site within a few days, which may afterwards open into superficial wounds. Painful sensation of varying intensity is almost always associated with these injuries. Application of Butyrum Medicinalis to the affected skin area within the first five (5) minutes ensuing to such contacts relieves pain and prevents blister formation.

3.2 Acneiform lesions

Acneiform lesions present in several variants with degrees of inflammation and pustulation; and these often co-exist with or leave behind melanated spots upon remission. Most cases are persistent and resistant to currently available medical therapy. Butyrum Medicinalis exerts curative action on acneiform lesions. A thick smear of it is rubbed gently to cover the affected area and left for 1—2 hours once or twice daily; and may be cleansed thereafter by bathing. Resolution of inflamed lesions rapidly occurs within a few days of treatment; pustules are rendered extremely amenable to extraction with a finger within a few weeks; and black spots resolve in the long term.

3.3 Abscesses; Boils; Staphyloid lesions

Staphyloid lesions normally will enlarge in the course of time and rupture at maturity to release a viscous, purulent, liquid discharge. Surgical incision and drainage has been the mainstay treatment for these conditions. Butyrum Medicinalis soothes and relieves pain when applied to these disorders; arrests maturation and induces resolution when applied in the early stage; and induces consolidation of pus in advanced lesions. Treatment of staphyloid lesions with Butyrum Medicinalis over a few days prior to surgical intervention will facilitate the procedure and afford complete extraction of pus. It may also be prescribed as an adjunct to oral antibacterial therapy.

3.4 Oedema

Butyrum Medicinalis relieves concomitant pain when applied to oedematous organs of the body, and may positively modify the underlying inflammatory process. It may be added as a topical adjunct in the treatment of oedematous disorders with or without known aetiologies.

3.5 Myalgias; Musculoskeletal pain; Massage therapy

The intrinsic antiinflammatory and pain-relieving effects of Butyrum Medicinalis prove useful adjuncts to oral medications in the treatment of myalgias and musculoskeletal pain. Additionally, Butyrum Medicinalis is useful as a lubricant in massage therapy for these affections. It is best applied subsequent to a warm bath.

3.6 Traumatic tumours; Contusions

As these disorders are caused by the inflammatory mechanism application of Butyrum Medicinalis to the lesions is effective for pain relief and induction of resolution of the inflammation. A thick smear is rubbed gently on the affected areas shortly after the traumatic event, and then twice daily or more frequently. This treatment may be prescribed with or without a course of oral analgesics.

3.7 Insect stings

Butyrum Medicinalis may be prescribed as the principal treatment for insect stings that do not present with systemic involvement. Application of it to affected sites effects pain relief and induces resolution of associated inflammation. Local treatment with Butyrum Medicinalis may also induce dislodgement of implanted mouthparts.

3.8 Calorie supplementation

Biochemically fats are the richest source of energy in human diets. Butyrum Medicinalis is an edible fat and may be added for dietary calorie supplementation in the therapeutic management of undernutrition and low body weight. For this usage Butyrum Medicinalis may be applied as a cooking fat or directly added to a meal at the table.

3.9 Humectant

In the concept here a humectant is any substance that is applied as a cosmetic to promote the retention of moisture in the skin. The use of Butyrum Medicinalis as a general ointment for the skin is widely established, and traditional knowledge imputes to it the effects of a healthy, supple skin with regular application. In the countries where the product is native it is highly esteemed for treatment of dry skin.

3.10 Vulnerary

The effectiveness of Butyrum Medicinalis for wound management has also been demonstrated in traditional practices. In Ghanaian folk medicine it is applied on a suitable dressing material to the glans penis after circumcision to accelerate healing of the wound; and as ointment base one or more active ingredients are admixed into it and applied for treating superficial wounds. Butyrum Medicinalis is believed to effect rapid healing of wounds and to prevent scar formation.

4. QUALITY STANDARDS

4.1 Organoleptic characteristics

Butyrum Medicinalis is a soft fatty solid, bland taste, creamy white to pale yellow in colour, with a mild characteristic smell.

4.2 Composition

It is a rather complex mixture separable by means of well-known chemical and physical methods into four(4) distinct component fractions discussed briefly as follows, and which are also put into two(2) primary categories, on the basis of molecular nature, namely; A. Glyceride fractions – that is, free fatty acids, olein and stearin: B. Non-Glyceride fraction.

4.2.1 Free fatty acids

These are end-products of hydrolytic degradation of the glyceride fractions during the storage and processing of shea nuts. As an index of poor quality Butyrum Medicinalis should contain as least of free fatty acids as possible, all necessary precautions observed to limit their production during its preparation.

4.2.2 Olein fraction

This is the low melting point oil (liquid) fraction that is chemically composed of the triglycerides of unsaturated fatty acids, among which oleic acid [C18:1] predominates, with only trace combinations of saturated fatty acids.

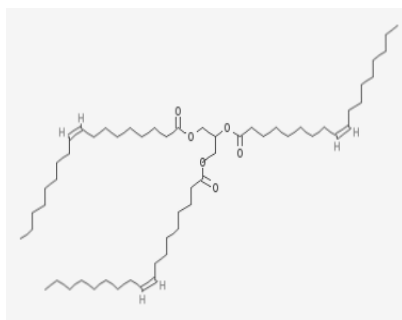


FIGURE 4.1: Triolein

4.2.3 Stearin fraction

The relatively higher melting point fat (solid) fraction essentially consisting of the triglycerides of mainly stearic acid [C18:0] in mixed combinations with minor amounts of other saturated fatty acids.

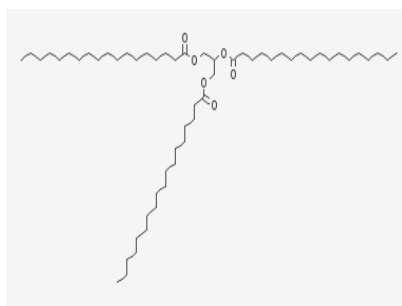


FIGURE 4.2: Tristearin

4.2.4 Non-glyceride fraction

Also referred to as the unsaponifiable fraction this category includes a large number of diverse chemical constituents that are resistant to the saponification process. Butyrum Medicinalis owes its excellent medicinal qualities principally to the biological activities of these chemical entities. Phytochemical screening of our wonderful herbal is progressing steadily and, sooner or later, the chemical particulars of this non-glyceride fraction will be fully characterized.

Table 4.1 below and the chart following represent a handful sample of compounds in this fraction which have consistently been isolated and reported in the works of several researchers.

Table 4.1: Some reported compounds in the unsaponifiable fraction of Butyrum Medicinalis

Terpenoid esters:

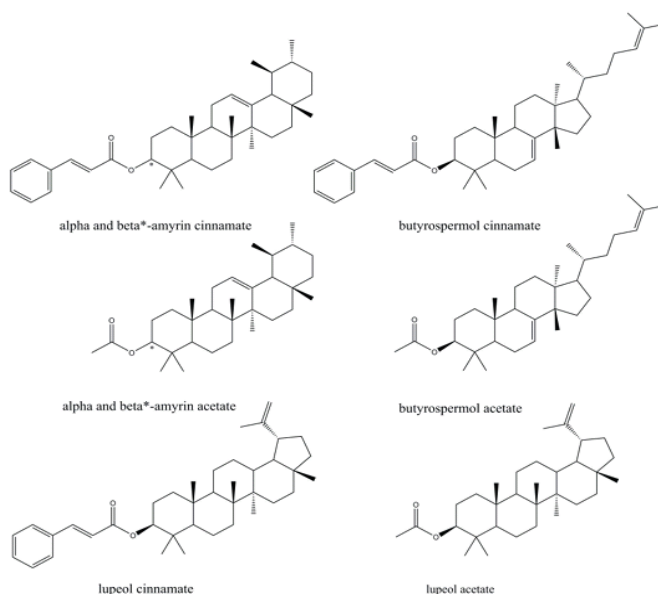
1. α -Amyrin cinnamate
2. α -Amyrin acetate
3. β -Amyrin cinnamate
4. β -Amyrin acetate
5. Butyrospermol cinnamate
6. Butyrospermol acetate
7. Lupeol cinnamate
8. Lupeol acetate

Terpenols:

1. α -Amyrin
2. β -Amyrin
3. Lupeol
4. Butyrospermol
5. Taraxasterol
6. Parkeol
7. 24-Methylene-24-dihydroparkeol
8. 24-Methylene cycloartanol
9. Dammaradienol
10. 24-Methylene dammarenenol

Vitamin E compounds:

1. α -Tocopherol
2. β -Tocopherol
3. γ -Tocopherol
4. δ -Tocopherol



4.3 Physical properties

Table 4.2: Physical properties of Butyrum Medicinalis

Test	Specification
Moisture content (% w/w)	0.00—0.05
Insoluble impurities (% w/w)	0.00—0.09
Relative density at 40°C (g/mL)	0.89—0.93
Refractive index at 44°C	1.4620—1.4650
Melting point (°C)	32—40
Volatile matter at 105°C (% w/w)	Below 0.20

4.4 Chemical properties

Table 4.3: Chemical properties of Butyrum Medicinalis

Test	Specification
Free fatty acids (% w/w)	0.0—1.0
Peroxide value (mEq/Kg)	0.0—10.0
Saponification value (mg KOH/g)	170—190
Iodine value (wijs)	50—60
Unsaponifiable fraction (% w/w)	Min. 8.0
Soap content (% w/w)	Below 0.005
Fatty acid profile (% w/w):	
Lauric acid [C12:0]	Below 1.00
Myristic acid [C14:0]	Below 0.70
Palmitic acid [C16:0]	2.00—10.00
Palmitoleic acid [C16:1]	Below 0.30
Stearic acid [C18:0]	25.00—50.00
Oleic acid [C18:1]	36.00—62.00
Linoleic acid [C18:2]	1.00—11.00
Linolenic acid [C18:3]	Below 1.00
Arachidic acid [C20:0]	Below 3.50
Metallic contaminants (mg/Kg):	
Lead (Pb)	Max. 0.10
Arsenic (As)	Max. 0.10
Iron (Fe)	Max. 5.00
Copper (Cu)	Max. 0.40

4.4.1 Chemical additives

Butyrum Medicinalis should not contain any chemical or pharmaceutical additives.

4.4.2 Pesticide residues

Specific pesticide contaminants should be controlled in conformity with national regulations.

4.5 Microbiological quality

Butyrum Medicinalis should be free of specific pathogenic microorganisms. The following quality requirements are additionally applicable;

Table 4.4: Microbiological standards of Butyrum Medicinalis

Test	Specification
Total viable count [cfu/g]	Max. 1×10^3
Mold count [cfu/g]	Max. 1×10^2
Aflatoxins	Max. 4 parts per billion (ppb)

5. BOTANICAL SOURCE

Butyrum Medicinalis is extracted from the kernels of the ripe fruits of the shea butter tree, botanically referred to as

Butyrospermum parkii (Kotschy) Fam. Sapotaceae.

5.1 Taxonomy

Kingdom:	Plantae
Phylum:	Tracheophyta
Class:	Magnoliopsida
Order:	Ericales
Family:	Sapotaceae
Genus:	<i>Butyrospermum</i> (Kotschy)
Species:	<i>Butyrospermum parkii</i>
Subspecies:	<i>Paradoxa</i>
	<i>Nilotica</i>

5.1.1 Note on nomenclature

Taxonomic literature depict that the shea butter tree has been independently classified by two botanists in the course of history; firstly in 1807 by the German botanist Karl Friedrich von Gaertner (1772—1850) as *Vitellaria paradoxa*, apparently with a focus on the morphology of the kernels of the fruits. Subsequently, the Austrian botanist Karl Georg Theodor Kotschy (1813—1866) also named the tree as *Butyrospermum parkii* in 1865.

Kotschy's nomenclature has several merits over Gaertner's, including; one, the specific name (*parkii*) accords due credit to the historical contribution of Mungo Park as the first person to formally introduce botanical specimens of the tree to European community; and two, the generic name (*Butyrospermum*) implicitly recognizes the fact that the seed of the tree was then the only known botanical source of true fat, when the latter term is physico-chemically defined.

So therefore, whilst well cognizant of the popular preference for Gaertner's *Vitellaria paradoxa*, on the basis of the foregoing reasons, the author is personally inclined to Kotschy's nomenclature.

5.2 Natural distribution

The shea butter tree grows wild within the savannah belt of the African continent stretching over a land area estimated to be around 500—750 Km in width and 5000 Km in length from the west to the east. The tree is known to be indigenous to the following countries; Senegal, Guinea Bissau, Guinea, Sierra Leone, Mali, Cote D'Ivoire, Burkina Faso, Ghana, Benin, Togo, Niger, Nigeria, Cameroon, Chad, Central African Republic, Sudan, Democratic Republic of the Congo, Uganda, and Ethiopia.

The subspecies *nilotica* predominates in East Africa, whereas subspecies *paradoxa* is naturally occurring in the western African countries.



FIGURE 5.1: Shading depicting natural distribution of *B. parkii*.

5.3 Plant habits

The current population of shea butter trees in what is commonly referred to as the “shea belt” grows wild and is not cultivated. Seeds of the tree are dispersed unconsciously by bats, birds, livestock, rodents, and humans as they feed on the tasty, nutritious shea fruits. Farmers allow trees with the desirable morphological characteristics to stand during land preparation for cultivation, and in the course of time, this traditional practice has led to a state that has been described as “semi-domestication” of the shea butter tree.

The shea butter tree is a deciduous tree of medium height (7—25m), with a highly branched, dense, spreading, round to hemispherical crown. Bark of a fully matured tree is conspicuously thick, corky, horizontally and longitudinally deeply fissured. The slash is pale pink, discharging a white latex as do broken twigs and petioles. Leaves occur in whorls at the tips of branchlets.

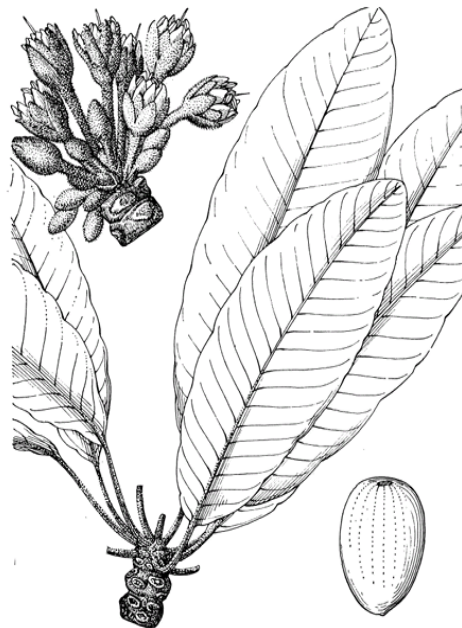


FIGURE 5.2: Mature shea butter tree, foliage, flowers and fruit.

The shea butter tree grows very slowly and typically the first fruits are yielded when trees are 15—20 years old but, once established, fruition may continue for up to 300 years. The first fruits produced are smaller both in size and quantity, but fruit characteristics reach optimum values sometime within the fifth decade of life. The trees produce flowers within the months of December—March, when trees are almost leafless, and the fruits mature between April—September.

5.4 Shea nuts

The fruit of the shea butter tree is a drupiferous fruit measuring on average 5—8 cm in length and 3—4 cm in width. Young fruits are usually greenish in colour but at maturity turns yellowish-green to brown and the edible nutritious pulp becomes soft with a sweet or astringent taste. Fully ripe fruits fall to the ground beneath the tree and are collected by natives at short frequent intervals. Fruits that are not picked up from the ground germinate quickly.

The seeds of the fruits, commonly called shea nuts, are obtained by manually removing or eating off the thick mesocarp (pulp) of the fruits. Each seed is elliptical in shape, measuring about 2—4 cm long and 1—2.5 cm wide, and covered by a smooth, shiny brown shell. Within the seed is the shea kernel, forming the endosperm of the seed, and which are separable by manually cracking the shells of the seeds after a brief period of drying. Quantitatively, drying shea nuts to a moisture content of 7% by weight yields between 150—300 seeds per kilogram.

Shea kernels are usually reddish-brown in colour with wrinkled surfaces. They contain on dry weight basis between 35—54 % of edible fat, the same fat that when extracted by the method discussed herein is being codified as *Butyrum Medicinalis*.

6. METHOD OF PREPARATION

6.1 Separation of kernels

Shea fruits must be passed through the following procedures to separate the kernels within three (3) days of collection from the field in order to avoid seed germination and to assure high quality characteristics of the butter to be extracted.

Depulping:

The pulp of the fruits should be removed with the aid of any suitable tool carefully so as not to break the nuts.

Washing:

The shea nuts are then washed thoroughly in clean water to rid them of all sticking fragments of pulp.

Parboiling:

Using a lidded stainless steel vessel boil the shea nuts in clean water for a period of 30—40 minutes.

Drying:

Spread the parboiled shea nuts on raised mats to dry in direct sunlight. Drying is carried on until the nuts rattle when shaken.

Cracking of nuts:

The shea nuts are cracked on a stone tablet by hitting them lightly with a wooden mallet, and the kernels are separated from the broken shells.

Desiccation:

Dry the kernels further in the sun until a moisture content of between 5—7 % by weight is achieved.

Sorting:

Visually inspect the lot of kernels to remove all impurities, organic debris, shrivelled, discoloured, mould-infested, or any sort of defective kernels. The dry shea kernels may then be filled into clean jute sacks for storage, or may be processed directly to extract butter.

6.2 Extraction of butter

The following procedures constitute the method that has been employed traditionally for extraction of butter from shea kernels.

Crushing:

The shea kernels are broken down to coarsely sized particles either by pounding in a wooden mortar or by using a mechanical

crusher.

Roasting:

Then follows a roasting stage, when the broken lot is roasted until the bits are brittle and shine with a visible oil coating. Roasting may be done in a large clay pot or stainless steel pan and turning steadily with a rod, or by using a sort of the manual rotary cylinders locally employed for roasting nuts.

Milling:

The lot is allowed to cool and then ground to a smooth paste in a mill.

Hydrothermal separation:

The paste is mixed into a predetermined quantity of clean water in a stainless steel vessel to form a thin slurry; then boiled gently for a period of between 1—2 hours to make the molten butter separate to the surface. Upon putting out the fire and whilst the slurry is still hot the molten butter is carefully skimmed off into a smaller stainless steel vessel.

Evaporation:

The collection is then subjected to gentle boiling to expel the water entrapped in the molten butter during the skimming off step. Boiling is continued until no water is visually detectable in the molten butter.

Filtration:

The hot butter is then passed through a piece of clean calico to filter out all particulate and colouring matter. The filtrate is collected in another stainless steel vessel and then subjected to a conditioning step as following.

Conditioning:

The cooling butter is conditioned in a clean room by stirring it in whole with a rod at short frequent intervals. The purpose of conditioning is to achieve a smooth-textured butter and to avoid the formation of a crystalline consistency. This step is continued until the butter hardens.

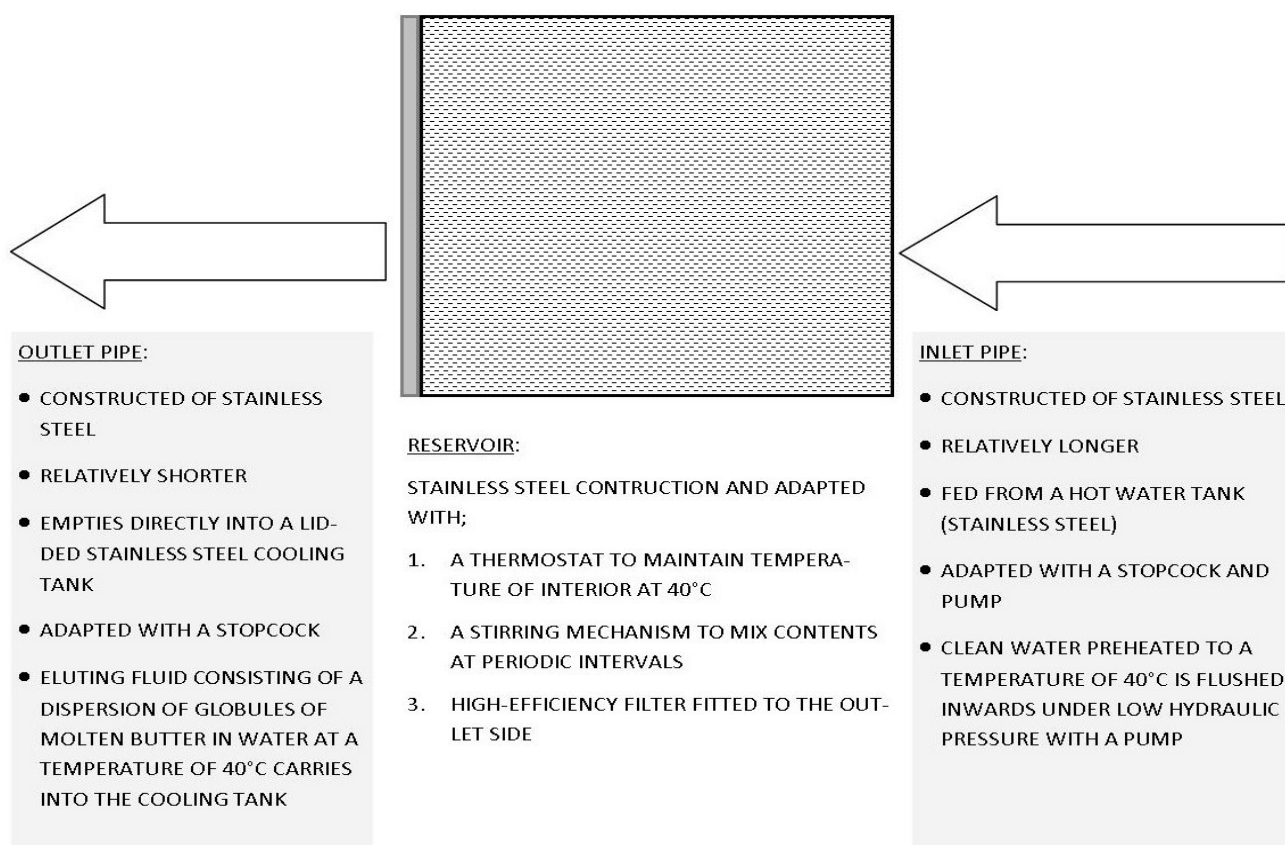
Packaging:

The butter is then partially remelted with gentle but steady stirring and directly filled into the final containers.

6.3 Suggested improvement

It is reasonable to anticipate that the extensive heat treatment to which shea kernels are subjected during the traditional method for extraction of butter will adversely impact on the quality characteristics of the butter extracted. In order to maintain quality characteristics of butter at the desirable levels, it is imperative to process shea kernels in an extraction plant that affords minimum exposure of the kernels to heat and air. The following schematic diagram depicts one such design for an improved method for butter extraction.

FIGURE 6.1: A SCHEMATIC DIAGRAM FOR AN IMPROVED BUTTER EXTRACTION PLANT



The lot of raw shea kernels is ground to a very fine powder in a mill, skipping the initial roasting step. The kernel powder is mixed into a predetermined quantity of clean water to form a thin slurry and then filled into the reservoir. The thermostat and stirring mechanism are set into operation and the slurry is kept in incubation for a period of between 12—24 hours. This treatment achieves the separation (hydrothermal separation) of butter from the kernel matrix as well as the extraction of lipid-soluble kernel constituents into the molten butter fraction in situ.

The inlet pipe is opened to slowly flush clean water preheated to a temperature of 40°C through the reservoir under low hydraulic pressure with the aid of the pump. The outlet pipe is opened shortly afterwards to allow the passage of the eluting fluid, consisting of fine globules of molten butter dispersed in the stream of hot water. This pipe empties directly into a lidded stainless steel cooling tank. Elution of the reservoir is continued until no traces of fatty globules are visually detectable (exhaustion) in the eluting fluid when sampled, at which time both the inlet and outlet pipes are closed.

The eluted fluid is allowed to cool slowly in the cooling tank until solid butter separates to the surface of the aqueous medium. The solid butter is skimmed off into a smaller stainless steel vessel, remelted to a temperature around 40°C, and then treated with an adequate quantity of any suitable chemical desiccant to remove entrapped moisture.

Whilst still at 40°C the fatty suspension is passed through a mechanized filtration system to remove the chemical desiccant and other particulate impurities. The filtrate is collected into another stainless steel vessel, then ensues the terminal steps of conditioning followed by packaging as already discussed in this section.

7. REFERENCES

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